

CLASS 494, IMPERFORATE BOWL: CENTRIFUGAL SEPARATORS

SECTION I - CLASS DEFINITION

Apparatus and process, not provided for elsewhere, for the breaking up or subdividing of material, which material comprises a mixture of fluids or fluent substances, into two or more components by utilizing a rotatable, receptacle-like member having a generally solid wall, and commonly termed a bowl, for subjecting the material to centrifugal force.

- (1) Note. When the material is subjected to centrifugal force, the usual tendency is for the heavier component(s) (e.g., the “heavies”) to move outwardly from the axis of rotation of the member and the lighter component(s) (e.g., the “lights”) to move inwardly toward the axis. When plural heavier components of more than one density are present in the material, the outward movement ordinarily results in stratification, with the most dense component forming the layer nearest the wall, and so forth. When the heavier component, or one or more of a plurality thereof, is particulate in nature, the resulting layer, or layers, tends to be more or less solid.
- (2) Note. Most frequently, the member is capable of receiving and holding the material while at rest, and thus is truly a receptacle; in some instances (e.g., a member in the form of a open-ended cylinder), however, it can receive and hold material only when in its operating (i.e., rotating) mode.
- (3) Note. The use of the phrase “generally solid” to describe the wall of the member is not intended to infer that the wall behaves as anything other than an imperforate surface insofar as the separating function is concerned; rather, the purpose of the qualifying word is to acknowledge that there sometimes are one or more openings (e.g., discharge apertures) in the wall which serve a nonseparating function. See also Subclass References to the Current Class, below.

SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS

A centrifugal extractor, per se, for treating textiles is not in Class 494 if of the imperforate bowl type, inasmuch as the mixture involved is not one which this class (494) provides for. (See References to Other Classes, below.) If the extractor is perforate in nature, it may be proper for Class 210 (e.g., subclasses 360.1+).

LINE WITH CLASS 196 AND WITH CLASS 208

While the treating of a nominally mentioned oil by merely subjecting it to the action of an imperforate bowl, centrifugal separator does not go beyond the scope of this class (494), the apparatus of Class 196 and the processes of Class 208, in References to Other Classes, below, involve more; for example, (a) apparatus, or process, respectively, pertaining to an additional, chemical treatment of the oil, or (b) specific properties (e.g., the composition) of the oil or of one or more of its components.

SECTION III - SUBCLASS REFERENCES TO THE CURRENT CLASS

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 43, (2) Note, for a discussion of the phrase “generally closed,” and see the Class Definition, (3) Note, above.

SECTION IV - REFERENCES TO OTHER CLASSES

SEE OR SEARCH CLASS:

- 29, Metal Working, subclass 279 for a hand tool which is particularly adapted for applying or removing component parts of a centrifugal separator.
- 34, Drying and Gas or Vapor Contact With Solids, subclasses 312+ for a process of that class which involves subjecting the material being treated to centrifugal force, and subclasses 58+ for apparatus which utilizes centrifugal force.
- 57, Textiles: Spinning, Twisting, and Twining, subclasses 76+.
- 68, Textiles: Fluid Treating Apparatus, subclasses 23+ for a machine of that class which is combined with a liquid extractor and wherein the extractor is centrifugal in nature. A centrifugal extractor, per se, for treating textiles also is in that area (23+) if of the imperforate bowl type, inasmuch as the mixture involved is not one which this class (494) provides for. For an

- extractor that is perforate in nature, see Lines With Other Classes and Within This Class, above.
- 73, Measuring and Testing, subclasses 535+.
- 95, Gas Separation: Processes, for processes involving steps resulting in separation of a gas from a fluid mixture comprising (a) a gas and solid or liquid particles entrained therein, (b) a liquid and gas entrained therein, or (c) a plurality of gases. However, gas separation processes that use an imperforate bowl, centrifugal separator are proper for Class 494.
- 96, Gas Separation: Apparatus, for apparatus used in separation of a gas from a fluid mixture comprising (a) a gas and solid or liquid particles entrained therein, (b) a liquid and gas entrained therein, or (c) a plurality of gases. However, gas separation apparatus that is an imperforate bowl, centrifugal separator is proper for Class 494.
- 99, Foods and Beverages: Apparatus, subclasses 452+ for apparatus of that class utilized for the mechanical, fluid or heat treatment of dairy food. Prominent in this class (494), however, is the separating of raw milk into one or more heavier components (e.g., skim milk) and one or more lighter components (e.g., cream).
- 118, Coating Apparatus, subclasses 52+.
- 124, Mechanical Guns and Projectors, subclasses 4+.
- 127, Sugar, Starch, and Carbohydrates, subclass 19 for apparatus of that class for treating sacchariferous material involving the treatment of sugar crystals and wherein the apparatus includes means for applying centrifugal force, and subclass 56 for a process of that class directed to the separation, in a mechanical manner, of impurities from a sugar solution and wherein centrifugal force is relied upon to separate impurities from a sugar solution which is of a different specific gravity than the impurities.
- 134, Cleaning and Liquid Contact With Solids, subclass 17 and 33.
- 156, Adhesive Bonding and Miscellaneous Chemical Manufacture, subclass 74.
- 159, Concentrating Evaporators, subclasses 6.1+.
- 162, Paper Making and Fiber Liberation, subclass 384.
- 164, Metal Founding, subclasses 114+, 175, and 286+.
- 184, Lubrication, subclasses 6.24+ for a system of lubrication which is provided with means for treating the lubricant of the system and wherein the treatment is in the nature of purification, which may involve a separating operation.
- 184, Lubrication, subclass 43, 70, and 77.
- 196, Mineral Oils: Apparatus, subclass 14.5 for apparatus of that class for separating wax from a petroleum oil for either recovering the wax or purifying the oil, and subclasses 46+ for apparatus adapted for separating either impurities or nonmineral oil components from mineral oil. (See Lines With Other Classes and Within This Class, for the line with Class 494.)
- 200, Electricity: Circuit Makers and Breakers, subclass 80.
- 208, Mineral Oils: Processes and Products, appropriate subclasses, for a process of that class for the recovery or treatment (including separating) of naturally occurring mineral oil, which process results in the production of a purified or modified oil or of coke. (See Lines With Other Classes and Within This Class, above, for the line with Class 494.)
- 209, Classifying, Separating, and Assorting Solids, appropriate subclasses, for process and apparatus for separating solid materials and assorting or segregating them in grades or classes according to physical characteristics. The relationship of Class 209 with this class (494) is explained in (6) Note of the class definition of Class 209, which reads as follows: "This class does not include apparatus or methods which involve the use of bowls or receptacles rotating at speed high enough to develop sufficient centrifugal force to separate one class of solids from others unless there is "amalgamation" involved, in which case such apparatus or methods are classifiable in subclass 60 and 199 of this class. Cases not falling within the exception noted are classifiable in Class 494, Imperforate Bowl: Centrifugal Separators. This class, however, does include some borderline cases where it is not clear that the separation of the classes of solids is wholly dependent upon centrifugal force generated by high speed rotation of the receptacle."
- 210, Liquid Purification or Separation, subclasses 360.1+ for apparatus of that class wherein the constituents of a mixture are separated by passing the mixture through a medium having openings (i.e., a filter) and wherein the medium is adapted for rapid movement about an axis of rotation, subclasses 781+ for a process of that class for separating one constituent of either a liquid-liquid or a liquid-solid mixture and wherein motion, relative to its support or hous-

- ing, is imparted to the filter medium and further wherein the mixture is caused to pass through the medium by centrifugal force, and subclasses 787+ for a process for separating one constituent of either a liquid-liquid or a liquid-solid mixture and wherein centrifugal force is developed by cyclonic movement of the mixture (but not involving movement of the filter); also, see Lines With Other Classes and Within This Class, above.
- 239, Fluid Sprinkling, Spraying, and Diffusing, subclass 7.
- 241, Solid Material Comminution or Disintegration, appropriate subclasses, for process or apparatus of that class when combined with process or apparatus for the separation of material. The relationship of that class (241) to the material separating classes is explained in Lines With Other Classes and Within This Class, in the class definition thereof, which reads, in part, as follows: "Class 241 is superior to the material separation classes and, therefore, provides for processes and apparatus in which comminution is combined with steps or means to separate the material into classes according to the physical characteristics of its components, before, during, or after the comminuting operation. See subclasses 9+, 24 and 68+ or, if the separation involves applying a fluid to the material, subclasses 19, 20 and 38+."
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 8, 114, 270, and 311.
- 266, Metallurgical Apparatus, subclass 204 and 227+.
- 277, Seal for a Joint or Juncture, subclasses 427+ and 433.
- 366, Agitating, subclass 263.
- 415, Rotary Kinetic Fluid Motors or Pumps, subclasses 13+, 25, and 89.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 72 for apparatus of that class comprising means for analyzing a liquid or solid sample and wherein the means includes a centrifuge.
- 427, Coating Processes, subclass 240.
- 451, Abrading, subclasses 465+ and 506.

SECTION V - GLOSSARY

BOWL

A receptacle-like member having generally-imperforate

sidewalls and constituting that portion of a SEPARATOR within which the subdividing of material into two or more components takes place, or, at least, commences. Ordinarily considered as part of the member are such devices or structure as are either affixed thereto or integral therewith. The art term, rotor, is sometimes used to mean approximately the same as BOWL. (See the Class Definition, (2) Note and (3) Note, above, and see Subclass References to the Current Class, above, for a discussion of the phrase "generally closed.")

SEPARATOR

The combination of a BOWL plus such other devices or structure not clearly a part of the BOWL as are necessary to constitute apparatus of the kind capable of subdividing material by subjecting it to centrifugal force within the BOWL. The art terms, centrifuge and centrifugal, are sometimes used to mean approximately the same as SEPARATOR.

SUBCLASSES

1 WITH CONDITION RESPONSIVE MEANS:

This subclass is indented under the class definition. Apparatus provided with means which reacts to a condition, or a change of condition, of the separator, or the environment of the separator, or the material entering, within, or departing from the separator, the reaction of the means serving as a response to the condition or the change therein.

- (1) Note. The means may range from a relatively sophisticated system for controlling the operation of the separator, which system may include a means to sense a condition and a means to respond to the information sensed, to a mere element of the separator, which element, by virtue of, for example, (a) its design or (b) the material of which it is formed inherently reacts to a condition to which it is exposed, subjected, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 11, for a separator provided with cyclic or time control means.

SEE OR SEARCH CLASS:

210, Liquid Purification or Separation, subclasses 97+ for apparatus of that class which is responsive to flow, fluid pressure, or material level, and subclasses 143+ for apparatus which has automatic control.

2 For controlling outlet valve:

This subclass is indented under subclass 1. Apparatus wherein the means is one which serves to operate, or to regulate the operation of, a valve which controls an outlet of the separator, usually located on the receptacle-like member.

3 In response to location of inner boundary of heavy component:

This subclass is indented under subclass 2. Apparatus wherein the condition to which the means reacts is the locus defining the innermost extent to which stratification of the heavier component of the material has progressed within the member.

- (1) Note. While the inner boundary of one component usually coincides with the outer boundary of another component, and therefore represents their interface, the inner boundary of the heavier component sometimes lends itself to being located more precisely.

4 In response to centrifugal force:

This subclass is indented under subclass 2. Apparatus wherein the condition to which the means reacts is the effect of the force imposed upon it by the rotation of the member.

- (1) Note. The means may be no more than a normally-closed or a normally-open valve which is caused by the force to which is subjected to change to its opposite mode.

5 For controlling inlet valve:

This subclass is indented under subclass 1. Apparatus wherein the means is one which serves to operate, or to regulate operation of, a valve which controls an inlet of the separator, which valve occasionally is located on the receptacle-like member.

- (1) Note. Included herein is art wherein the condition to which the means reacts is the weight of the bowl or its contents.

6 In response to level of liquid-type material in bowl or in reservoir for supplying bowl:

This subclass is indented under subclass 5. Apparatus wherein the condition to which the means reacts is the location of the surface of a quantity of material to be, or being, separated, which surface is that formed by the material when it is in either the receptacle-like member or in a container which furnishes (e.g., meters) it to the member, and which material is in the nature of either a liquid or a slurry.

7 For controlling drive of (a) bowl or (b) driven means within bowl:

This subclass is indented under subclass 1. Apparatus wherein the means is one which serves to operate, or to regulate the operation of, a motor, transmission or other device which drives either (a) the receptacle-like member or (b) a conveyor, an agitator or other driven device located in the member.

- (1) Note. The function and operation of a driven means within the bowl is discussed at length in (2) Note and (3) Note of subclass 50 below.
- (2) Note. Included herein is art wherein the condition to which the means reacts is an excessive vibration on the part of the bowl.

SEE OR SEARCH THIS CLASS, SUBCLASS:

50, as explained in the reference thereto appearing in (1) Note above.

8 In response to load imposed upon driven means:

This subclass is indented under subclass 7. Apparatus wherein the condition to which the means reacts is the effort (e.g., the torque) which the conveyor, agitator or other driven device in the member must develop to move the material which it engages therein.

9 In response to speed of bowl or rotarily-driven means therewithin:

This subclass is indented under subclass 7. Apparatus wherein the condition to which the means reacts is the velocity, usually expressed in revolutions per minute, at which either the member, or a device therein which is driven rotatably, turns, or a change in that value.

- (1) Note. Included herein is art wherein the condition to which the means reacts is the difference between the speed of the bowl and that of the rotarily-driven means.

10 WITH MEANS FOR INDICATING, INSPECTING, MEASURING, SIGNALING, OR TESTING:

This subclass is indented under the class definition. Apparatus provided with means for carrying out, or for facilitating the carrying out of, those purposes ordinarily associated with the functions of indicating, inspecting, measuring, signaling, or testing, which means might comprise, but are not limited to, a tachometer, a viewing port, a scale, an audible or visual alarm, or a viscosimeter, respectively.

- (1) Note. Obviously, the functions may not be mutually exclusively insofar as the means for carrying them out are concerned; hence, the fact that it may not be possible to restrict the association of a particular means to only one, specific function is immaterial.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 414+ for gas separation apparatus having inspection means and subclasses 417+ for gas separation apparatus having signals, indicators, measuring, or testing means.
- 73, Measuring and Testing, appropriate subclasses, for measuring or testing means peculiar to that class.
- 210, Liquid Purification or Separation, subclasses 85+ for apparatus peculiar to that class which is provided with alarm, indicator, register, recorder, signal or inspection means.

- 324, Electricity: Measuring and Testing, appropriate subclasses, for measuring and testing means peculiar to that class.

11 WITH CYCLIC OR TIME CONTROL MEANS:

This subclass is indented under the class definition. Apparatus provided with means for causing the separator, or a component thereof, to operate in accordance with (a) a predetermined sequence of events (e.g., program control by a cam), or (b) the progression of time (e.g., the length of time to be allotted to each of one or more phases of the separating function) as determined by a device having at least the capability of establishing a time interval (e.g., a timer) and possibly having also the capability of relating the time interval to the time of day (e.g., a clock-timer).

- (1) Note. The term "automatic" frequently is utilized in describing the operation of the art of this subclass.
- (2) Note. The reference to a "cam" in (a) above is not intended to infer that a cam may not be found elsewhere in the class; see, for example, subclasses 47+ below, where the "other movement" may result from the use of a cam.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 47+, as explained in the reference thereto appearing in (2) Note above.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 424+ for gas separation apparatus having timing or changeable programming means.
- 210, Liquid Purification or Separation, subclasses 138+ for apparatus of that class which is provided with time control.

12 INCLUDING MEANS OR STRUCTURE FOR PROMOTING SAFETY:

This subclass is indented under the class definition. Apparatus which includes a provision in the nature of a device or element, or merely a structural feature, which is indicated as being intended to reduce or eliminate one or more

hazards of a kind associated with the separator, especially during its operation.

- (1) Note. If mere strength of the bowl wall, for example, is involved, and there is no express statement relating that property to safety, classification in subclass 81 below, rather than here (12), is proper.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 81, as explained in the reference thereto appearing in (1) Note above.

13 WITH MEANS FOR EXCHANGING HEAT:

This subclass is indented under the class definition. Apparatus provided with means for changing the heat content of either the material or the separator.

SEE OR SEARCH CLASS:

- 165, Heat Exchange, appropriate subclasses, for process and apparatus for transferring heat from one material to another.
- 210, Liquid Purification or Separation, subclasses 175+ for apparatus of that class provided with a heater or a heat exchanger.
- 219, Electric Heating, subclass 389 for a heating device of that class which is associated with a container or an enclosure for material to be heated and wherein the container or enclosure is adapted to be rotated about an axis.

14 Comprising or including means for cooling:

This subclass is indented under subclass 13. Apparatus wherein the means for changing the heat content comprises or includes a device, fluid or system for reducing the heat content.

SEE OR SEARCH CLASS:

- 62, Refrigeration, appropriate subclasses, for process and apparatus peculiar to removing heat from a substance, or the product of such removal, or the handling of the latter as a stored product.

15 WITH MEANS FOR LUBRICATING:

This subclass is indented under the class definition. Apparatus provided with means for furnishing antifriction material to one or more regions thereof.

- (1) Note. The material ordinarily is of a fluid or a fluent nature; e.g., oil, grease, graphite.

SEE OR SEARCH CLASS:

- 184, Lubrication, appropriate subclasses, for lubrication and lubricators, generally.

16 INCLUDING PLURALITY OF MINIA-TURE BOWLS (E.G., TEST TUBES) DISTRIBUTED ABOUT A ROTATABLE CARRIER AND READILY REMOVABLE THEREFROM:

This subclass is indented under the class definition. Apparatus which includes two or more, extremely small, receptacle-like members for receiving the mixture and holding it during separation, and a revolving support for holding, at intervals spaced therearound, the members and further wherein the members are retained by the support in such a manner that they may be more or less easily disengaged therefrom.

- (1) Note. The members most frequently comprise test tubes into which may be placed blood samples for separation into, for example, red cells and plasma.
- (2) Note. The spacing of the containers on the support is such that the assembly will remain balanced.
- (3) Note. Including in this and the indented subclasses is art directed to only a sub-combination of the revolving support and/or the receptacle-like member.
- (4) Note. In view of the uniqueness of the art of this area (16+), cross-referencing between this area and the other principal areas of the class is, for the most part, neither appropriate nor beneficial.

SEE OR SEARCH CLASS:

- 210, Liquid Purification or Separation, subclass 782 for a process of that class for separating one constituent of either a liquid-liquid or a liquid-solid mixture and wherein motion, relative to its support or housing, is imparted to the filter medium and further wherein the mixture is caused to pass through the medium by centrifugal force and additionally wherein the mixture comprises blood.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 44+ for a device of that class for treating transfusible blood.
- 424, Drug, Bio-Affecting and Body Treating Compositions, subclasses 529+ for a composition of that class wherein the active ingredient is an animal tissue extract of undetermined constitution and further wherein the composition contains either a blood extract or a structurally undetermined component obtained from blood.
- 604, Surgery, subclass 507 for methods of introducing therapeutic material into or removing it from the vasculature system.

17 And means for introducing either material or auxiliary fluid into bowls:

This subclass is indented under subclass 16. Apparatus which includes also means for feeding either (a) the material which is to be separated or (b) one or more fluids, which fluid or fluids are not initially a part of the material to be separated, to the members.

- (1) Note. While not initially a component of the material supplied for separation, the fluid of this subclass sometimes becomes an indistinguishable part of either the material or a separated component thereof.
- (2) Note. Typical of the art of this subclass is the supplying of a liquid for "washing" a sample of blood.

18 Including conduit of flexible umbilical cable type:

This subclass is indented under subclass 17. Apparatus which further includes a flaccid, tubular element for conducting the mixture or other fluid from a stationary supply, or supply connection, to or from the receptacles while they are rotating with the carrier.

- (1) Note. The development and use of a conduit of this nature is generally considered to reduce certain maintenance and contamination problems inherent in the rotating seal which it eliminates.

19 And means for rotating each bowl about own axis:

This subclass is indented under subclass 16. Apparatus which includes also means for imparting rotary movement, about its principle axis, to each of the members.

- (1) Note. Here, the centrifugal force for causing separation of the mixture is developed in part by the revolving of the support and in part by the additional turning of each member about its own axis.

20 Having bowls, or holders therefor, pivotably attached to carrier for tilting during rotation of carrier:

This subclass is indented under subclass 16. Apparatus wherein either each member, or each of a plurality of receivers provided with accommodations for one or more members, is joined to the support in a manner (e.g., pivoted at a locus above the center of gravity of the member or the receiver) whereby the lower portion of each member or receiver will swing, about a horizontal axis, outwardly and upwardly when acted upon by the centrifugal force developed by the revolving of the support.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 16, for related art but wherein, for example, (a) the outward and upward movement of the lower portion of the member is not in the nature of turning about an axis, or (b) each member is

fixedly supported at a predetermined degree of tilt.

21 Comprising flexible bowls embraced by pockets provided therefor in carrier:

This subclass is indented under subclass 16. Apparatus wherein the members are flaccid in nature and are held within cavities, compartments or the like located in the revolving support.

- (1) Note. Prior to being filled with the mixture, the member of this subclass may be collapsed; i.e., flat. Upon filling, it assumes the shape of its cavity, thereby sometimes resembling a liner therefor. The confinement thus provided enables the member to withstand the centrifugal force to which it is subjected.

22 INCLUDING INTRODUCTION OF DIFFERING-WEIGHT FLUIDS (E.G., LIQUIDS) FOR COUNTERCURRENT FLOW:

This subclass is indented under the class definition. Apparatus which includes supplying to the bowl two or more fluids, usually two liquids but sometimes a liquid and a gas, which differ in specific gravity and which difference enables radially outwardly movement of the heavier fluid to take place more or less simultaneously with radially inwardly movement of the lighter fluid.

- (1) Note. A principle function of the opposing flow is to achieve intimate contact of one fluid with another, which fluids most frequently are two, immiscible or partly immiscible liquids, and which contact is sometimes described in terms of one fluid acting as a solvent upon the other.
- (2) Note. The purpose of the intimate contact (occasionally described as "sliding surface contact") and subsequent separation sometimes is to promote a chemical reaction between the liquids, or, occasionally, it may be for transferring one or more components from one liquid to the other.
- (3) Note. Separators of the countercurrent flow type are particularly useful in separating liquids whose specific gravities differ so slightly that separation in a con-

ventional separator might prove impractical.

- (4) Note. Separating apparatus of the kind peculiar to this subclass is sometimes identified as an "extractor" (where two liquids are involved) or an "evaporator" (where a liquid and a gas are involved).

SEE OR SEARCH CLASS:

- 210, Liquid Purification or Separation, subclass 799, for a process of that class for separating one constituent of a liquid-liquid mixture and wherein the liquids are immiscible.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 258+ for apparatus of that class having means for separating or dissolving a material constituent and wherein the means is of the liquid-liquid contact kind and further wherein the means includes a rotating chamber.

23 WITH MEANS FOR FURNISHING AUXILIARY FLUID TO MATERIAL OR APPARATUS:

This subclass is indented under the class definition. Apparatus provided with means for introducing, or for facilitating the introduction of, one or more fluids, which fluid or fluids are not initially a part of the material intended to undergo separation, to the material or to one or more components or elements of the separator.

- (1) Note. While not constituting a portion of the material as supplied for separation, the fluid of this subclass sometimes becomes an indistinguishable part of either that material or a separated component thereof.
- (2) Note. Included in this and the indented subclasses, especially subclasses 27+ is the introducing of a fluid for a cleaning purpose.
- (3) Note. Suction is not considered to be the introduction of a fluid within the concept of this and the indented subclasses; note, however, that suction for the purpose of reducing the pressure in a housing for a

bowl is provided for in subclass 61 below.

- (4) Note. The furnishing of a fluid for actuating a component (e.g., a valve) of the separator is included in this and the indented subclasses.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 13+, for a separator provided with means for exchanging heat, which means may involve a fluid in the nature of a medium of heat exchange.
- 15, for a separator provided with means for lubricating, which means may involve a fluid in the nature of a lubricant.
- 17, for a separator which includes a plurality of miniature bowls distributed about a rotatable carrier and readily removable therefrom and wherein means is provided for introducing either the material or an auxiliary fluid into the bowls.
- 61, as explained in the reference thereto appearing in (3) Note above.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 372+ for gas separation apparatus including inlet means for diverse gas or solid for gas treatment.
- 210, Liquid Purification or Separation, subclasses 198.1+ for apparatus of that class provided with means to add treating material.

24 Energy of fluid utilized for driving bowl:

This subclass is indented under subclass 23. Apparatus wherein the fluid is under pressure or otherwise possesses energy, and wherein that property of the fluid is used for imparting rotation to the member.

- (1) Note. The fluid may serve only to enhance the rotation of a bowl which is provided also with driving means of a different nature.
- (2) Note. Most commonly, a fixed or adjustable nozzle is utilized to direct the fluid against one or more regions of the member, which regions may be particularly

adapted to receive and react to the force of the fluid.

25 Gas other than air:

This subclass is indented under subclass 23. Apparatus wherein the fluid introduced is in the nature of a gas, and wherein the gas has a composition which serves to distinguish it from that gas commonly considered to constitute "air".

26 Air at atmospheric, or greater, pressure:

This subclass is indented under subclass 23. Apparatus wherein the fluid introduced is air which is at either the pressure normal to the region in which the separator is located or a pressure which is elevated from that pressure.

- (1) Note. See (3) Note of subclass 23 above.
- (2) Note. Included in this subclass is a body of art which is concerned with counteracting the derogatory effect on the separating process caused by the movement of air within a housing provided for the bowl, which movement is created most frequently by the friction developed between the rotating bowl and the air surrounding it. The means making this particular art proper for this subclass usually comprises an inlet for admitting outside air to the housing, which latter air is utilized to at least partially overcome the undesired results (e.g., intermingling, or loss, of liquids which have been separated) of the movement of the air already in the housing.
- (3) Note. As a sidelight to (2) Note., it can be observed that an aperture for admitting air, if located in a lower region of the housing, may serve also as an outlet for unwanted substances (e.g., liquids, foreign particles) which otherwise would accumulate there.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 60+, especially subclasses 60 and 63 for a separator which includes an exterior housing for the rotatable bowl, which subclasses include a collection of art that is concerned with the movement of only that air which already is in

housing, as contrasted with the situation discussed in (2) Note above.

27

Liquid:

This subclass is indented under subclass 23. Apparatus wherein the fluid introduced is in the nature of a liquid.

- (1) Note. See the reference to this subclass (27) contained in (2) Note of subclass 23 above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 23, as explained in the reference thereto appearing in (1) Note above.

28

Moving radially inwardly toward axis of rotation of bowl:

This subclass is indented under subclass 27. Apparatus wherein the liquid flows from one or more regions removed from the axis about which the member turns (e.g., an inlet on the periphery of the member) in the direction of that axis.

- (1) Note. The countercurrent flow provided for in subclass 22 above represents another provision for radially inwardly flow of fluid, but is to be distinguished from the subject matter of this subclass (28) on the basis that there (22) the flow is that of one of the two fluids which are essential to the separation, whereas here the radially inwardly flow is that of an auxiliary fluid (i.e., an auxiliary liquid).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 22, as explained in the reference thereto appearing in (1) Note above.

29

Furnished at plural locations:

This subclass is indented under subclass 27. Apparatus wherein the liquid is introduced at more than one place.

- (1) Note. Most commonly, the liquid is introduced into the member, and, most frequently, by utilizing plural conduits.
- (2) Note. Two or more different liquids may be involved.

30

Including one or more valves in incoming path:

This subclass is indented under subclass 27. Apparatus wherein at least one valve is provided for controlling the liquid which is enroute to the separator.

31

INCLUDING PLURALITY OF SEPARATE AND DISTINCT BOWLS:

This subclass is indented under the class definition. Apparatus which includes two or more receptacle-like members, no one of which members is contained in whole or in part in any other member, and each of which members serves as the locus of a separating function.

- (1) Note. The separating functions taking place in the members sometimes are identical; however, they are more likely to differ in, for example, the kind or the phase or the degree of separation.
- (2) Note. "Separate" is not intended to exclude an externally touching (e.g., a rolling contact) relationship between two or more of the members.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 16+, for a separator which includes a plurality of miniature bowls (e.g., test tubes) distributed about a rotatable carrier and readily removable therefrom.
- 44, for a separator wherein the rotatable bowl comprises a plurality of bowls which are partly or wholly within one another.

SEE OR SEARCH CLASS:

- 55, Gas Separation, subclasses 482+ for apparatus of that class including plural separators.
- 210, Liquid Purification or Separation, subclasses 294+ for apparatus of that class including diverse, distinct separators, and subclasses 322+ for apparatus including plural, distinct separators.

32 And means external of bowls for conducting material therebetween:

This subclass is indented under subclass 31. Apparatus which includes means (e.g., a conduit, surface, etc.) for enabling material to move from one member to another, which means is located, at least in part, outside of one or both of the members with which it is associated.

- (1) Note. Included herein are instances wherein material moves back to a member which it occupied at an earlier stage of the separating function; e.g., “feed-back”.

33 Having bowls equally spaced from a central axis of rotation for orbiting thereabout:

This subclass is indented under subclass 31. Apparatus wherein the members describe a common path as they turn about an axis from which each member is equidistantly removed.

SEE OR SEARCH THIS CLASS, SUBCLASS:

16+, as explained in the reference thereto appearing in subclass 31 above, and with the further observation that the bowls of that area (16+) are spaced from and turn about a central axis of rotation.

34 Having bowls spaced along common axis of rotation:

This subclass is indented under subclass 31. Apparatus wherein the members occupy successive, but not overlapping, positions along the axis about which they turn.

- (1) Note. While the driving means here typically is a shaft common to each of the members, concentric shafts are sometimes utilized.

35 BOWLS AND MEANS EXTERNAL THEREOF FOR RECIRCULATING MATERIAL:

This subclass is indented under the class definition. Apparatus wherein a receptacle-like member is provided with means, located at least in part outside thereof, for conducting material away from the member and subse-

quently returning all or a part of that material to the member.

- (1) Note. The material leaving and later returning to the member may constitute, for example, (a) material for which a higher degree of separation is desired than could be obtained by passing through the member once, or (b) material which was in excess of the separating capacity of the member upon the occasion of its initial entry thereto, or (c) leakage which has been collected.
- (2) Note. The outside means may include a driven device (e.g., a pump) for moving the material.
- (3) Note. The means, while outside, at least in part, of the member, is not necessarily outside of any such structure as may be provided for enclosing the member.

SEE OR SEARCH THIS CLASS, SUBCLASS:

32, for a separator which includes a plurality of separate and distinct bowls and which also includes means external of the bowls for conducting material therebetween.

SEE OR SEARCH CLASS:

55, Gas Separation, subclasses 338+ for apparatus of that class provided with recycle means.

210, Liquid Purification on Separation, subclasses 194+ for apparatus of that class involving recirculation.

36 WITH MEANS FOR FILTERING:

This subclass is indented under the class definition. Apparatus provided with means for removing an undesired or unintended constituent (e.g., particles of a solid) from material which is enroute to, or within, or enroute from, a separator, and wherein the means is a medium of a porous or perforate nature which is placed in the flow path of the material and prevents the constituent from continuing to accompany the remainder of the material.

- (1) Note. The means usually is in the nature of a screen, sieve, strainer, or the like (e.g., a fibrous batt).

SEE OR SEARCH CLASS:

- 196, Mineral Oils: Apparatus, subclass 46.1, for apparatus of that class adapted for separating either impurities or nonmineral oil components from mineral oil and wherein the apparatus is provided with filtering means.
- 210, Liquid Purification or Separation, subclasses 348+, for apparatus of that class including a filter.

37**PROCESS:**

This subclass is indented under the class definition. Method of (a) breaking down a mixture into two or more component parts by means of an imperforate bowl, centrifugal separator or (b) operating an imperforate bowl centrifugal separator for such a purpose.

SEE OR SEARCH CLASS:

- 95, Gas Separation: Processes, for processes of gas separation other than those using an imperforate bowl, centrifugal separator.
- 210, Liquid Purification on Separation, subclasses 600+ for processes of that class.

38**INCLUDING SEALING MEANS:**

This subclass is indented under the class definition. Apparatus which includes means for preventing the unintended movement of a gas, liquid or solid to or from, or from one region to another of, the separator.

- (1) Note. The tendency of a substance to move stems frequently from the existence of a pressure differential between the regions; however, other phenomena (e.g., gravity) may be responsible, instead.
- (2) Note. Included in this subclass 38 is a seal of other than a structural barrier type; e.g., a liquid seal.

SEE OR SEARCH CLASS:

- 55, Gas Separation, subclass 355 for apparatus of that class provided with a liquid trap seal or valve.

- 277, Seal for a Joint or Juncture, for a generic sealing means or process, subclasses 345+ for a seal between relatively movable parts (i.e., a dynamic seal).

39**For protecting evacuated, bowl-enclosing housing against gaseous infiltration:**

This subclass is indented under subclass 38. Apparatus wherein the means comprises a device or element for preventing the leakage or air or any other gas at ambient pressure into, and thereby raising the absolute pressure within, a structure in which the pressure has been reduced to less than atmospheric and within which the bowl is located.

- (1) Note. A common reason for providing an evacuated region for the bowl is to reduce the resistance of air to the bowl's rotational movement, as in the instance, for example, of an ultraspeed centrifuge.
- (2) Note. See (3) Note of subclass 23 above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 23, as explained in the reference thereto appearing in (2) Note above.

40**Comprising seal, or element cooperating therewith, movable axially for controlling outlet on periphery of bowl:**

This subclass is indented under subclass 38. Apparatus wherein the means comprises either a seal (e.g., a gasket) or an element (e.g., a surface for engaging the seal), which is movable in a direction paralleling the axis of the member for the purpose of opening or closing one or more apertures located, usually, on a line representing a circumference of the member.

- (1) Note. In some instances, either the seal or the cooperating element is a component of a movable portion (e.g., one of the hemispheres of a spherical bowl) of the member.
- (2) Note. Sealing of the kind found in this subclass occasionally is a hallmark of a "closed centrifuge." In that event, it may be associated with conditions such as (a) a positive pressure in the bowl (as developed, for example, by feeding into the

bowl under pressure), (b) pressure at the outlet resulting from flow resistance in a conduit receiving the discharge, (c) avoiding leakage which might otherwise develop as a result of lateral motion of the bowl induced, for example, by vibrations encountered at higher speeds of rotation, or (d) a necessity for preventing air from getting into the material being discharged (and thus, in some instances, avoiding “frothing”).

41 For sealing between stationary and moving elements:

This subclass is indented under subclass 38. Apparatus wherein one region moves relative to the surrounding area and the other region does not.

42 INCLUDING DRIVEN MEANS AT LEAST PARTIALLY EXTERNAL OF BOWL FOR MOVING MATERIAL THERETO OR THEREFROM:

This subclass is indented under the class definition. Apparatus which includes means (e.g., a pump, a screw conveyor) which is located either (a) entirely outside the receptacle-like member, or (b) partly outside the member and having a portion extending thereinto, and wherein the means serves to move the material either (a) toward, or toward and into, or (b) away from, or out of and away from, the member.

- (1) Note. In the majority of instances, the means of this subclass is not driven by the drive shaft of the member.

43 ROTATABLE BOWL:

This subclass is indented under the class definition. Apparatus comprising the receptacle-like member, or one or more elements or portions thereof, of a separator, which member is (a) generally closed insofar as its sidewall structure is concerned and (b) subjected to turning about its principal axis for causing material supplied to it to be divided into two or more components.

- (1) Note. While termed a “bowl,” and described as “receptacle-like,” the member may range from a sphere to an open cylinder.

- (2) Note. “Generally closed,” as used in describing the sidewall structure, is intended to exclude openings which are the essence of a separating function (e.g., as in separating by filtering), but is not intended to exclude, for example, an opening which is utilized for discharging one or more of the products of a separating operation performed within the bowl.

- (3) Note. Where means or structure comprising subject matter for any one of subclasses 82, 83 or 84 below is present, the claiming of the bowl in name only shall not be deemed to mandate original classification here (43).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 16+, for a bowl of the kind utilized by a separator which includes a plurality of miniature bowls distributed about a rotatable carrier and readily removable therefrom.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclass 279 as explained in the reference thereto appearing in section IV of the class definition above.

44 Comprising plurality of bowls partly or wholly within one another:

This subclass is indented under subclass 43. Apparatus wherein the member comprises two or more receptacle-like members, which members at least partially enclose one another.

- (1) Note. Included in this subclass is art wherein the enclosed member, or one of a plurality thereof, may not bear much resemblance to a “bowl” in the sense that the term generally is used in the class, but in which art that member is consistently described and treated as comprising a bowl, drum, rotor, etc.
- (2) Note. Although it is the exception rather than the rule for the enclosed member, or one of a plurality thereof, to be driven differently (e.g., independently, oppositely, separately) than the enclosing member, those instance in which it does

occur may present an overlapping relationship with regard to the art of subclasses 50+ below, especially subclass 52 thereof. For example, a body of art which exists in that area discloses a drum-like device (sometimes termed a “deflector”) which is within the member and is driven differently therefrom; however, that art is distinguishable, at least in part, from the art of this subclass (44) by the fact that the material to be separated never enters the drum (i.e., the separation takes place within the space between the outer surface of the drum wall and the inner surface of the member wall).

- (3) Note. The enclosed member, or one of a plurality thereof, sometimes bears a strong physical resemblance to the art of subclasses 66 through 80, below, especially subclasses 77+ thereof, and, in some instances, is classified here (44) rather than there only on the basis of having been accorded “member” status for the reason described in (1) Note above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 31+, for a separator which includes a plurality of separate and distinct bowls.
 50+, especially subclass 52 thereof, as explained in the reference thereto appearing in (2) Note above.
 66, through 80, especially subclasses 77+ thereof, as explained in the reference thereto appearing in (3) Note above.

- 45 Including flexible, removable lining therein:**
 This subclass is indented under subclass 43. Apparatus including structure within the member in the nature of a membrane which (a) serves to line all or some portion of the interior of the member, (b) is elastically or plastically deformable, and (c) is adapted to be inserted into or taken out of the member.

- (1) Note. The membrane may be container-like in form.
 (2) Note. The lining of this subclass is not related to, and should not be confused with, the art term, “liner”, which fre-

quently is applied to certain structure within the member such, for example, as that provided for in subclasses 66 through 80 below.

- (3) Note. Included in this subclass is art directed to the subcombination of the membrane.

46 Including bearing means adapted to enable bowl to establish dynamic axis of rotation:

This subclass is indented under subclass 43. Apparatus which includes one or more surfaces which engage either the member or an element (e.g., the drive spindle) thereof and which surfaces are so constructed, mounted, etc., as to permit the member, when placed in rotation, to define, as the axis about which it turns, a line which may be slightly offset, in whole or part, from that line which appears to represent its geometric center when at rest.

- (1) Note. The purpose here is to allow the axis of rotation to be dictated by the center of gravity of the rotating mass.

SEE OR SEARCH CLASS:

- 210, Liquid Purification or Separation, subclass 363 for apparatus of that class wherein the constituents of a mixture are separated by passing the mixture through a medium having openings, (i.e., a filter) and wherein the medium is capable of movement and further wherein the medium is adapted for rapid movement about an axis of rotation and additionally wherein adjustable means is provided to position the center of gravity of the structure on the geometric axis of rotation.
 384, Bearings, subclass 193 for a bearing for a rotary element wherein the contact involved is of a sliding or a line nature and further wherein the bearing is adapted to receive a load imposed in the direction of the axis of rotation and additionally wherein the load is a thrust load on a vertical shaft and lastly wherein the bearing and the shaft are given limited relative motion to allow for oscillation of the shaft about its vertical axis.

47 Including means for imparting other movements to bowl in whole or in part before, during or after its axial rotation:

This subclass is indented under subclass 43. Apparatus which includes means for moving the member, or at least one portion thereof relative to another portion, in some manner other than its customary turning about its principal axis, and wherein the means may act either during the time the member is turning or prior to or subsequent to such time.

- (1) Note. If the means acts during rotation of the member, the other movement probably plays a part in the separating function; if, on the other hand, the means acts at some other time, the other movement is likely to be for a purpose not directly related to the separating.
- (2) Note. For the purposes of this subclass, vibration is considered to constitute movement.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 19, for a separator which includes a plurality of miniature bowls (e.g., test tubes) which are distributed about a rotatable carrier and are readily removable therefrom and wherein means is provided for rotating each bowl about its own axis, also.
- 33, for a separator which includes a plurality of separate and distinct bowls and wherein the bowls are equally spaced from a central axis for rotating about that axis, also.
- 46, for a separator having a rotatable bowl which includes bearing means adapted to enable the bowl to establish a dynamic axis of rotation, the result of which may be a slight lateral shifting of the axis and, therefore, of the bowl.

48 Axial movement of one portion of bowl wall relative to another (e.g., for discharging):

This subclass is indented under subclass 47. Apparatus wherein the wall of the member is subdivided in an axial direction for creating at least two separable parts, and the means moves

at least one of the parts axially away from or toward at least one other of the parts.

- (1) Note. The movement provided for herein frequently is related to providing an exit for material leaving the member.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 40, for a separator which includes sealing means, and wherein the means comprises a seal, or a member coacting therewith, which is movable axially for controlling an outlet on the periphery of the bowl.

49 Driven by energy of material supplied:

This subclass is indented under subclass 43. Apparatus wherein the energy for causing the member to turn about its axis is derived, in whole or in part, from the pressure or other energy possessed by the material to be, being, or which has been, separated.

50 Including driven material-moving means therein:

This subclass is indented under subclass 43. Apparatus which includes driven means located within the member for imparting movement to all or any portion of the material contained in the member, which movement differs in either form or function from that caused by the rotation of the member about its axis.

- (1) Note. The movement of the material by the means of this area (50+) may be for such purposes as agitating, distributing, expelling, mixing, or merely transporting.
- (2) Note. The means of this area frequently is identified in the art as a "conveyor." However, in view of the variety of purposes served by the means, the term "conveyor" is believed to be unnecessarily restrictive, and, accordingly, has not been relied upon in this reclassification of the art.
- (3) Note. For the movement imparted by the means to differ from that resulting from the rotation of the member, the means must either move in some fashion other than rotating about an axis, or, if of the

rotating kind, must, for example, (a) turn about an axis which is not the same as the axis of the member, or (b) turn in a different direction than the member, or (c) turn at a different speed (not uncommonly, a differential as small as one rpm) than the member. Inasmuch as the instance noted in (c) is the most simple and straightforward manner in which to obtain a difference in movement, and, therefore, is the one most commonly utilized, the differential is sometimes merely disclosed and not claimed.

- (4) Note. Included in this and the indented subclasses is a small amount of art wherein the means is not positively driven; for example, the means may be caused to move by (a) its engagement with material contained in the bowl, or (b) its frictional contact with a positively driven element, such as a feed tube.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 44, for a separator wherein the rotatable bowl comprises a plurality of bowls which are located partly or wholly within one another and wherein at least one of the bowls may be driven relative to at least one other bowl; also, see the reference to this area (50+) appearing in (2) Note thereof.

SEE OR SEARCH CLASS:

- 366, Agitating, appropriate subclasses, for process and apparatus for operating on fluid, visious, plastic, or fluent particulate material for causing portions of the material to move irregularly with respect to each other so as to intermix, and particularly subclasses 219+, for an agitator having a movable mixing chamber.

51 Plural driven means:

This subclass is indented under subclass 50. Apparatus wherein two or more driven means, at least two of which means are independent of one another in one or more characteristics, are present.

- (1) Note. The following are considered to exemplify, but are not intended to limit,

the interpretation of "independent": (a) a reciprocating means and a rotating means, (b) a plurality of rotating means, at least one being driven at a different speed, or in a different direction, than at least one other thereof, (c) a plurality of rotating means, at least one having a different axis of rotation than at least one other thereof, or (d) a plurality of rotating means driven by a common shaft, at least one serving to impart movement (1) in a different direction than another (e.g., a conveying screw segment having a left-handed thread and another segment having a right-handed thread) or (2) of a different nature than another (e.g., conveying by one, stirring by another).

52 Rotatably driven coaxially with bowl but differing as to direction or speed:

This subclass is indented under subclass 50. Apparatus wherein the driven means is one which is rotated about an axis, and wherein that axis coincides with the axis of rotation of the member, and further wherein the means is driven in a direction, or at a speed, which differs from the direction, or the speed, of the member.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 44, for a separator wherein the rotatable bowl comprises a plurality of bowls which are located partly or wholly within one another and wherein at least one of the bowls may be driven relative to at least one other bowl; also, see the reference to this subclass (52) appearing in (2) Note thereof.

53 Including element having helical blade:

This subclass is indented under subclass 52. Apparatus wherein the driven means includes a material-engaging portion which is in the nature of a screw thread; e.g., a screw conveyor.

SEE OR SEARCH CLASS:

- 198, Conveyors: Power-Driven, subclasses 657+ for a conveyor section of that class in the nature of a screw.

54 Modified blade:

This subclass is indented under subclass 53. Apparatus wherein the portion is so altered or changed as to be structurally dissimilar, in one or more respects, to a conventional screw thread, the alterations or changes being for a purpose related to the portion's function in the separating operation.

- (1) Note. The modification may be found in the external surface of the portion, or it may involve the interior thereof; in the latter instance, however, the inner region of the "blade" portion of the thread, rather than merely the interior of the "shaft" upon which it is formed, must be involved.

55 Including plurality of discrete pushing or scraping elements moving proximate to material collecting surface of bowl:

This subclass is indented under subclass 52. Apparatus wherein the driven means includes two or more separate (i.e., noncontinuous), material-engaging elements (e.g., blades, plows), which elements force material from their path as they travel adjacent those portions of the member upon which the material tends to accumulate.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 53+, for a related material-moving means which may, as in this subclass (55), move material in a pushing or scraping manner, but wherein the material-engaging portion is in the nature of a screw thread.

56 Including discharge-related structure in nature of (a) outlet having device for controlling quantity of flow, (b) element associated with pickup of material and adjustable for varying quality of flow, or (c) static scraper or the like for engaging material in moving bowl:

This subclass is indented under subclass 43. Apparatus which includes structure that is involved in either the preparation for departure, of the departure, or both, of material from the member and which structure takes the form of (a) an exit passage which includes a valve or like device for varying the amount of material

moving through the passage, or (b) an element which is related to the gathering of material that is to be conducted out of the member and which element is repositionable or otherwise adjustable for changing the ratio of the lighter component or components to the heavier component or components in the material gathered, or (c) a blade or similar abutment which, except for purposes of repositioning, is stationary relative to a member which is turning about its axis and serves to dislodge (e.g., peel off) material being moved against it by the member.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 2+, for a separator which is provided with means which is responsive to a condition for the purpose of controlling an outlet valve.
- 40, for a separator which includes sealing means and wherein the means comprises a seal, or an element cooperating therewith, which is movable axially for controlling an outlet on the periphery of the bowl.
- 48, for a separator wherein the rotatable bowl includes means for imparting other movement to the bowl, in whole or in part, before, during or after its axial rotation and wherein the movement is the axial shifting of one portion of the bowl wall relative to another portion thereof (e.g., for the discharging of material).

57 Element associated with pickup of material and adjustable for varying quality of flow:

This subclass is indented under subclass 56. Apparatus comprising an element which is related to the gathering of material that is to be conducted out of the member and which element is repositionable or otherwise adjustable for changing the ratio of the lighter component or components to the heavier component or components in the material gathered.

- (1) Note. The repositioning ordinarily involves movement in a direction radially of the member.
- (2) Note. The element may be merely the free end of a pickup tube, which end can be relocated in a radial direction. In another instance, the element may be a

perforated cover for the end of such a tube, which cover is threadedly engaged with the tube and may be moved radially of the member by changing the amount of its threaded engagement with the tube. In still another instance, the element may be an externally- threaded bushing having an axial passage and threadedly engaged with an aperture in the wall of the member, and wherein, in the instance of vertically-oriented member, (a) a horizontally-arranged bushing may be rotated about its axis to vary its distance from the axis of the member, or (b) a vertically-arranged bushing, having its passage eccentric of its axis, may be rotated about its axis for varying the offset of its passage from the axis of the member.

- (3) Note. Occasionally, the regulation of the quantity of material exiting from the member at one or more locations may be utilized to vary the quality of material departing from the member, the departure usually taking place at a location or locations other than the first mentioned one or ones. Art of this nature may be found in subclass 56 above.
- (4) Note. Although the art of this subclass sometimes identifies the adjustable element as a “paring device” or “skimmer,” this subclass is by no means residual to such a component.

SEE OR SEARCH THIS CLASS, SUBCLASS:

56, as explained in the reference thereto appearing in (3) Note above.

58 Static scraper or the like for engaging material in moving bowl:

This subclass is indented under subclass 56. Apparatus comprising a blade or similar abutment which, except for purposes of repositioning, is stationary relative to a member which is turning about its axis, and serves to dislodge (e.g., peel off) material being moved against it by the member.

- (1) Note. Although the functional movement is that of the material rather than that of the blade, the latter is reposition-

able for certain purposes; for example: (a) for moving it out of the interior of the member when not needed for dislodging material, or (b) for adjusting it relative to the surface of the material for determining the depth to which the material will be removed.

- (2) Note. The material dislodged by the blade may be either material which is to be recovered or material which is merely to be disposed of; in the latter instance, the dislodging may be more nearly in the nature of an operation which infers, at least, a cleaning function.
- (3) Note. Included here is the means, if any, for repositioning the blade.

SEE OR SEARCH CLASS:

210, Liquid Purification or Separation, subclasses 372+ for apparatus of that class in the nature of a filter and wherein the extractor includes a provision for discharging residue and additionally wherein the provision comprises a residue engaging means (e.g., a doctor blade), and subclasses 391+ for a filter which is removable and is provided with cleaning means (see especially indented subclasses 396+ wherein the means may be in the nature of a scraper).

59 And structure to receive or guide material loosened:

This subclass is indented under subclass 58. Apparatus comprising structure which either accumulates, or provides a path for the movement of, material which has been dislodged by the blade.

60 Including housing for bowl:

This subclass is indented under subclass 43. Apparatus wherein the member is provided with structure for enclosing or shrouding it to one degree or another.

- (1) Note. The structure of this subclass usually serves to support the member.
- (2) Note. The structure may or may not be identified by terminology such as “housing,” “casing,” etc.

- (3) Note. As discussed in (2) Note of subclass 26 above and in the search note to this subclass (60) appearing there, this subclass contains art which relates to the movement, in the housing, of air which already is present there.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 26, as explained in the reference thereto appearing in (3) Note above.

61 With means for reducing, and maintaining, pressure in housing below that of environment:

This subclass is indented under subclass 60. Apparatus wherein the enclosing or shrouding structure is provided with means for (a) at least partially evacuating the structure relative to its surroundings and (b) keeping it approximately at that degree of evacuation.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 25, for a separator provided with means for furnishing an auxiliary fluid and wherein that fluid is a gas other than air. In this regard, it should be noted that, in the event that the gas is intended to replace air as the fluid present in the interior of the structure, it may be necessary to first draw off some portion of the air.
- 39, for a separator which includes sealing means for protecting an evacuated, bowl-enclosing housing against gaseous infiltration.

62 Serving to support bowl from above:

This subclass is indented under subclass 60. Apparatus wherein the enclosing or shrouding structure includes a provision for suspending the member.

63 For vertically-oriented bowl, and having plural receivers at top for separated components:

This subclass is indented under subclass 60. Apparatus wherein the enclosing or shrouding structure has an upper portion which comprises two or more compartments, into each of which is fed a separate component of the material.

- (1) Note. In their common form, the compartments are in stacked relationship, with the lower one serving to close the open top of the structure.

- (2) Note. Each compartment ordinarily is provided with a spout for the exit of the component.

- (3) Note. In the language of the art, "cover" is a term commonly applied to such a compartment.

64 Having structural provision for facilitating cleaning (e.g., quick take-apart):

This subclass is indented under subclass 43. Apparatus wherein the member has, as an aspect of its structure, one or more features which are intended to expedite, simplify or otherwise contribute to (e.g., by affording accessibility) the removal of material therefrom, frequently material which has accumulated therein during a separating operation.

- (1) Note. While the art of this subclass almost invariably includes a reference to "cleaning", an expression of that nature should not be interpreted as meaning, necessarily, that the material is not wanted; further in this regard, see (2) Note of subclass 58 above.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 23+, for a separator provided with means for furnishing auxiliary fluid, and particularly subclasses 27+ thereof wherein the additional fluid is a liquid; see also the reference to cleaning which appears in (2) Note of subclass 23.
- 58, as explained in the reference thereto appearing in (1) Note above.

65 Vertically-oriented, and including structural provision for bottom entry of material:

This subclass is indented under subclass 43. Apparatus wherein the member is one which turns about a vertical axis, and wherein the member includes structure defining an inlet or the like whereby material enters the member through that portion thereof which is lowermost.

- (1) Note. This subclass is concerned only with the locus of entry, which often bears no relationship to the region within the member at which the material is released for movement therewithin; for example, the material may enter through the bottom but remain within a feed tube until it reaches an upper region of the member.
- (2) Note. The inlet or the like may or may not include a device (e.g., a valve) for controlling the entry of material.
- (3) Note. Usually shown in the art of this subclass is the conduit (e.g., a hollow drive spindle) for conducting material to the inlet.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 5+, for a separator provided with condition responsive means for controlling an inlet valve.
- 23+, for a separator provided with means for furnishing auxiliary fluid, as contrasted with the admission here (65) of material.

66 Including structure located within bowl and defining axially-extending, helical flow path:

This subclass is indented under subclass 43. Apparatus wherein the member includes internal structure which moves with it and serves to establish a route for the movement of at least part of the material, and wherein the route established is in the form of a helix which parallels the axis of rotation of the member.

- (1) Note. Frequently, the structure of this subclass is tubular in nature, but it may be, instead, rodlike, striplike, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 44, for a separator wherein the rotatable bowl comprises a plurality of bowls which are partly or wholly within one another, and see (3) Note thereof for an explanation of the resemblance which sometimes exists between the art of that subclass (44) and that of this subclass (66).

- 53+, for a separator wherein the rotatable bowl includes driven material-moving means therewithin and wherein the means is driven rotatably, and coaxially with the bowl, but differs in direction or speed from the rotation of the bowl and further wherein the means includes an element having a helical blade.

67 Including structure located within vertically-oriented bowl and extending outwardly from central region (e.g., axis) thereof:

This subclass is indented under subclass 43. Apparatus wherein the member turns about a generally vertical axis and includes internal structure which moves with it, and wherein the structure is so formed and positioned as to extend away from either (a) the axis of rotation of the member, or (b) a locus somewhat removed from the axis, in a manner whereby it is directed, at least in part, toward a sidewall of the member.

- (1) Note. The phrase, "a locus somewhat removed from the axis", is necessitated by the fact that the region immediately surrounding the axis is sometimes (a) an open space, or (b) occupied by an element such as a feed tube.
- (2) Note. Although the structure of this and the indented subclasses extends in the direction of a sidewall of the member, it is the exception rather than the rule for it to engage therewith.
- (3) Note. The structure of this area usually presents a surface across which one or more components of the material flow when the member is turning about its axis.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 44, for a separator wherein the rotatable bowl comprises a plurality of bowls which are partly or wholly within one another, and see (3) Note thereof for an explanation of the resemblance which sometimes exists between the art of that subclass (44) and that of this area (67+).

68 Comprising plurality of elements, each concentrically encircling axis of bowl and spaced therealong:

This subclass is indented under subclass 67. Apparatus wherein the internal structure comprises, at least in part, a plurality of elements which are centered on and extend around the vertical axis of the member and which are arrayed (e.g., nested, stacked, etc.) along that axis in such a manner that at least a slight gap exists between any two adjacent elements.

- (1) Note. Although the elements have the axis as their geometric center, they frequently do not originate at the axis, as discussed in (1) Note of subclass 67 above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

67, as explained in the reference thereto appearing in (1) Note above.

69 Each extended generally normally to region, and having surface displaying three-dimensional configuration:

This subclass is indented under subclass 68. Apparatus wherein the outward extension of each of the elements is at more or less of a right angle to the axis, or to a locus somewhat removed from the axis, and wherein each element has at least one of its two, principal (i.e., more or less axially-facing) surfaces formed with a pattern which includes a depth (i.e., a normal-to-the-surface) dimension.

- (1) Note. See (1) Note of subclass 73 below.
(2) Note. See (2) Note of subclass 73 below.

SEE OR SEARCH THIS CLASS, SUBCLASS:

73, as explained in the reference thereto appearing in each of (1) Note and (2) Note above.

70 Each extending away from region with significant downward, as well as significant outward, component (e.g., nested cones):

This subclass is indented under subclass 68. Apparatus wherein each of the elements shows, in section, a profile which is directed not only appreciably outwardly, but also appreciably

downwardly, as the element extends away from the axis, or from a locus somewhat removed from the axis.

- (1) Note. The initial downward and outward direction of the element often results in imparting thereto the appearance of a cone, or, more specifically, a truncated cone.
(2) Note. The presence of a relatively small, inwardly- or downwardly-directed “flange” at the inner periphery of one or more of the elements is not considered to exclude such a group of elements from this and the indented subclasses.
(3) Note. While the downwardly and outwardly profile usually is linear in appearance, it occasionally shows as a line having some degree of curvature (e.g., the sides of the “cone” are bulged).
(4) Note. Frequently, structure is provided for spacing adjacent elements from one another; for a further discussion of this structure, see (2) Note of subclass 73 below.

SEE OR SEARCH THIS CLASS, SUBCLASS:

73, as explained in the reference thereto appearing in (4) Note above.

71 And the plurality divided vertically into two or more, physically separate or functionally distinct groups:

This subclass is indented under subclass 70. Apparatus wherein the plurality of elements comprise at least two groups of elements, one above another, and wherein the manner in which the groups can be differentiated may lie either (a) in the fact that one group is spaced from another group or (b) in the fact that one group plays a somewhat different role (e.g., is utilized at a different time) in the separating function than does another group.

72 And extending therebeyond generally downwardly:

This subclass is indented under subclass 70. Apparatus wherein each element extends additionally, beyond the downward and outward

portion, in a direction which is at least principally, if not exclusively, downward.

- (1) Note. The plurality of additional extensions of this subclass often presents the appearance of a plurality of concentric cylinders (if directed exclusively downward) or near-cylinders (if directed principally downward).

73 And one or more elements having surface displaying three-dimensional configuration:

This subclass is indented under subclass 70. Apparatus wherein at least one of the elements has one or both of its two, principal (i.e., more or less axially-facing) surfaces formed with a pattern which includes a depth (i.e., a normal-to-the-surface) dimension.

- (1) Note. Usually the pattern will appear on both surfaces, inasmuch as it is most commonly formed by stamping; e.g., a corrugated surface.
- (2) Note. There mere provision of an occasional dimple in one or both of the surfaces of an element, for the purpose of spacing it from the elements adjacent to it, is not considered to constitute subject matter for this subclass. On the other hand, some of the structure utilized for spacing elements from one another is more complex, especially that which not only spaces the elements but also guides the flow of material which is passing therebetween, which structure does, indeed, present a three-dimensional aspect that is properly classifiable here.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 69, for a separator having a rotatable bowl which is vertically-oriented and includes structure which extends outwardly from the central region (e.g., the axis) thereof and wherein the structure comprises a plurality of elements, each of which concentrically encircles the axis of the bowl and is spaced vertically therealong, and further wherein each element extends generally normally to the central region and has a surface which displays a three-dimensional configura-

tion; see also the reference to this subclass (73) appearing in each of (1) Note and (2) Note thereof.

- 70, in regard to the reference to this subclass (73) appearing in (4) Note thereof.

74 Comprising plurality of axially-extending, plate-like elements, each having its inner edge lying along central region:

This subclass is indented under subclass 67. Apparatus wherein the internal structure comprises, at least in part, a plurality of elements which (a) parallel the axis of the member, (b) have length (i.e., height) and width dimensions, especially the former, which greatly exceed their thickness dimension, and (c) each have the edge thereof which faces toward the interior of the member located proximate to either the axis or a locus parallel thereto and somewhat removed therefrom.

- (1) Note. For the purposes of this area (74+), "platelike" is not restricted to describing only an element which appears, in a horizontal section, as a straight line; in fact, indented subclass 75 provides for an element which shows, in such a section, as a curved line of one form or another.
- (2) Note. Subclass 79 below provides for a plurality of elements which may be structurally similar to the elements of this area (74+), but which lack the association with the central region of the member that is required here (74+). In some instances that lack of association results from the fact that the elements of that subclass (79) may originate at the wall of the member and extend inwardly, to one degree or another, therefrom. In the event that the presence, or absence, of an association with the central region is not clear, the doubt should be resolved in favor of classification here (74+).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 79, as explained in the reference thereto appearing in (2) Note above, and see, especially, (2) Note of that subclass (79).

75 And each extending outwardly in curve of changing or constant radius:

This subclass is indented under subclass 74. Apparatus wherein that dimension (i.e., width) of each element which extends outwardly describes, in a horizontal section, a nonlinear path in the nature of either a spiral or an arc of a circle.

- (1) Note. By virtue of their curvature, the elements of this subclass intersect radial lines of the member.
- (2) Note. The elements may be resilient in nature, in which event their curvature may be the result of their being forced, distortably, into position within the member.

76 Including plurality of axially-extending, tubular elements located within vertically-oriented bowl:

This subclass is indented under subclass 43. Apparatus wherein the member turns about a generally vertical axis and includes internal structure which moves with it, and wherein that structure comprises, at least in part, a plurality of elements which parallel the axis and are in the nature of hollow cylinders.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 44, for a separator wherein the rotatable bowl comprises a plurality of bowls which are partly or wholly within one another, and see (3) Note thereof for an explanation of the resemblance which sometimes exists between the art of that subclass (44) and that of this area (76+).

77 Each element concentric with axis of bowl:

This subclass is indented under subclass 76. Apparatus wherein each of the elements has, as its center, the axis of the member, whereby the elements are located one within another.

- (1) Note. The annular space between adjacent elements sometimes is subdivided by one or more vertical partitions into two or more, less-than-annular spaces, the purpose being to break up or prevent

flow in a direction circumferentially of the elements.

78 And at least one element having other-than-circular periphery:

This subclass is indented under subclass 77. Apparatus wherein one or more of the elements describes, in horizontal section, something other than a mere circle.

- (1) Note. The formation of the sidewall of an element in such a manner as to show, in plan, a periphery which comprises peaks and valleys, or the like, often is done for the purpose of increasing the surface area of the element.

79 Including plurality of axially-extending, plate-like elements located within vertically-oriented bowl:

This subclass is indented under subclass 43. Apparatus wherein the member turns about a generally vertical axis and includes internal structure which moves with it, and wherein that structure comprises, at least in part, a plurality of elements which (a) parallel the axis of the member and (b) have length (i.e., height) and width dimensions, especially the former, which greatly exceed their thickness dimension.

- (1) Note. See (1) Note of subclass 74 above, which is applicable here (79), also.
- (2) Note. See (2) Note of subclass 74 above for an explanation of the relationship between the platelike elements of that area (74+) and those of this subclass (79). It may be observed, additionally, that the platelike elements of this subclass (79) are somewhat more likely to be in the nature of vanes for accelerating material than they are to be, as in the instance of the 74+ area, surfaces forming paths of flow for material moving away from or toward the axis of rotation of the member.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 44, for a separator wherein the rotatable bowl comprises a plurality of bowls which are partly or wholly within one another, and see (3) Note thereof for an explanation of the resemblance

which sometimes exists between the art of that subclass (44) and that of this subclass (79).

74+, as explained in the reference thereto appearing in (1) Note and (2) Note above.

80 Including plurality of shelf-like elements located within vertically-oriented bowl and extending generally horizontally inwardly from wall thereof:

This subclass is indented under subclass 43. Apparatus wherein the member turns about a generally vertical axis and includes internal structure which moves with it, and wherein that structure comprises, at least in part, a plurality of elements which (a) have more or less planar, upwardly-facing surfaces and (b) extend more or less normally from the inner surface of the sidewall of the member toward the axis thereof.

(1) Note. The elements sometimes are rather abbreviated in their inward extent, in which event they may more nearly resemble distorted grooves formed in the sidewall surface.

81 Material of bowl wall:

This subclass is indented under subclass 43. Apparatus wherein the wall of the member is claimed in terms of the chemical, mechanical, metallurgical, or physical characteristics or properties of the substance or substances of which it is formed.

(1) Note. Exemplary of the art of this subclass is the claiming of the wall in terms of (a) the composition of the material utilized for making it, (b) its strengthening by the use of reinforcing elements or by laminating, or (c) its increased resistance to corrosion or wear by the provision of a coating (e.g., a plating) or a lining (e.g., a film).

SEE OR SEARCH THIS CLASS, SUBCLASS:

12, for a separator which includes means or structure for promoting safety, and see the reference to this subclass (81) appearing in (1) Note thereof.

82 INCLUDING VIBRATION DAMPING MEANS:

This subclass is indented under the class definition. Apparatus which includes means for reducing, eliminating or counteracting the development of unintended movement (e.g., oscillatory, reciprocatory) on the part of the separator or a component thereof.

(1) Note. The development of the unintended movement may indicate the existence of a condition of imbalance.

SEE OR SEARCH THIS CLASS, SUBCLASS:

7, for a separator provided with condition-responsive means for controlling the drive of either the bowl or a driven means within the bowl, and see especially (2) Note of that subclass.
43, particularly in regard to the reference to this subclass (82) appearing in (3) Note thereof.

SEE OR SEARCH CLASS:

68, Textiles: Fluid Treating Apparatus, subclasses 23.1+ for a machine of that class combined with a liquid extractor and wherein the extractor is of the centrifugal type and is provided with means to control or isolate vibration.
74, Machine Element or Mechanism, subclass 573 for a machine element in the nature of a flywheel or rotor which is provided with balancing means.
210, Liquid Purification or Separation, subclass 144 for apparatus of that class which has automatic control and wherein the control is responsive to vibration or unbalance, and subclass 363 for apparatus in the nature of a filter and wherein the filter is movable and comprises a centrifugal extractor and further wherein the extractor is provided with an adjustable rotation stabilizer.

83 INCLUDING BEARING STRUCTURE:

This subclass is indented under the class definition. Apparatus which includes one or more devices for aligning, supporting or otherwise holding a component which is subject to movement (e.g., linear, rotary) relative to a compo-

nent which is stationary, and isolating, to one degree or another, the effect of the movement of the one upon the nonmovement of the other.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 43, particularly in regard to the reference to this subclass (83) appearing in (3) Note thereof.
- 46, for a separator wherein the rotatable bowl includes bearing means adapted to enable the bowl to establish a dynamic axis of rotation.

SEE OR SEARCH CLASS:

- 384, Bearings, appropriate subclasses for bearings, per se.

84 INCLUDING SPECIFIC DEVICE OR STRUCTURE FOR DRIVING OR CONTROLLING BOWL:

This subclass is indented under the class definition. Apparatus which includes a prime mover, gear train, clutch, brake, or the like, for starting, rotating, or stopping, or otherwise regulating the speed of, the member, which prime mover, etc., is either claimed with specificity or else is claimed broadly but disclosed in detail.

- (1) Note. A nominal recital of, for example, "an electric motor", absent a disclosure of particular characteristics, properties, or structure thereof, is not sufficient for classification here.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 24, for a separator provided with means for furnishing auxiliary fluid thereto and wherein energy possessed by that fluid is utilized for driving the bowl.
- 43, particularly in regard to the reference to this area (84) appearing in (3) Note thereof.
- 47+, for a separator wherein the rotatable bowl includes means for imparting other movement to the bowl, in whole or in part, either before, during or after its axial rotation.

85 MISCELLANEOUS:

This subclass is indented under the class definition. Apparatus not otherwise provided for.

CROSS-REFERENCE ART COLLECTIONS

900 INVOLVING MIXTURE CONTAINING ONE OR MORE GASES:

Separating apparatus wherein at least one gas is present in the mixture entering the apparatus.

901 INVOLVING MIXTURE CONTAINING OIL:

Separating apparatus wherein oil of one kind or another is present in the mixture entering the apparatus.

902 INVOLVING THE USE OF MERCURY:

Separating apparatus wherein mercury is utilized, directly or indirectly, to contribute to, supplement, etc., the functioning of the apparatus.

END